

The Canadian Entomologist.

Vol. XLIII.

LONDON, SEPTEMBER, 1911.

No. 9

ON *CÆLOPISTHIA NEMATICIDA* PACK., A CHALCID PARASITE OF THE LARGE LARCH SAWFLY, *LYGÆONEMATUS ERICHSONII* HARTIG.*

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In the course of a study of the European and North American parasites of the Large Larch Sawfly, *Lygaonematus erichsonii* Hartig, which was begun several years ago, observations have been made on the life-history of this Chalcid parasite. Its abundance in the cocoons of *L. erichsonii* kept under observation would indicate that it is an important factor in the natural control of the sawfly in the Eastern States and Canada, and for this reason and also because hitherto it has been undescribed, the present account is written.

Packard† first referred to this parasite in the account of his investigations on *Lygaonematus erichsonii* which were made immediately after the latter insect had been discovered as a forest pest in the United States and Canada. He says :

"A number of cocoons sent us in 1882 by Mr. Atkins were found to be in every case tenanted by a minute chalcid parasite, belonging to the genus *Pteromalus*. If new it may be called *Pteromalus nematicida* (Plate XII, Fig. 8). About a hundred of these issued from the cocoons in the breeding-box during May, 1883. This parasite must, therefore, be a most destructive enemy of the larch worm."

Beyond the figure of the parasite, which is given and again reproduced with the above account in the Fifth Report of the United States Entomological Commission (1890), no further description is given. From the correspondence printed in this account of the injuries of the sawfly it would appear that Mr. Charles F. Atkins collected the aforementioned cocoons in Maine.

No further description of this insect, so far as I am aware, has been published since Packard provisionally named it.

*Contributions from the Division of Entomology, Ottawa.

†In "The Report of the Entomologist," "Ann. Rept. of the Commissioner of Agriculture, 1883," Washington, D.C., pp. 138-142.

Cocoons of *L. erichsonii* were collected in the larch section of the forest belt at the Central Experimental Farm, Ottawa, in May, 1910, and on May 21st, a few days after bringing them into the laboratory, 25 specimens of the Chalcid emerged; 22 specimens did not emerge, but were dissected out. A careful examination of the parasite indicated its similarity on the whole, but not entirely, to Packard's figure already mentioned. This was kindly confirmed by Mr. C. T. Brues, of the Bussey Institution of the Harvard University, who placed it in Förster's genus *Cælopisthia*. The occurrence of this parasite was discussed with Mr. W. F. Fiske, in charge of the Gipsy Moth Parasite Laboratory, Melrose Highlands, Mass., who also examined cocoons of *L. erichsonii* collected at Wellesley, Mass., and found the pupæ of this parasite in these cocoons on July 28th. Mr. Fiske arranged for cocoons to be collected for me from the same locality, and these were received on September the 13th. At this time practically all the larvæ of *L. erichsonii* have gone underneath the turf and have formed cocoons and are thus prepared for hibernation. It was upon this material that most of the following observations were made.

During my absence from Ottawa for several weeks, Mr. G. E. Sanders kept the records, and he has also drawn up the description of the adult at my request, which assistance I wish to gratefully acknowledge.

DESCRIPTION OF THE ADULT.

Cælopisthia nematicida Pack.

Female (Fig. 19).—Length, 1.7 to 2.1 mm. Average length of ten specimens, 1.92 mm. Colour black; the head and thorax closely and evenly reticulate, slightly hispid, giving strongly metallic dark green reflections; the abdomen black, smooth and glossy; antennæ non metallic, the scape and pedicel brown, the flagellum darker brown; coxæ for the most part black with a green metallic lustre, tips slightly brown; legs non-metallic pale-brown, femora fuscous; wings hyaline, venation pale-brown; eyes dark, variable somewhat, but usually giving a purplish reflection.



FIG. 19.—*Cælopisthia nematicida* Pack., female, x 12.

Head (anterior aspect), broadly oval; antennæ inserted on an imaginary line drawn from base to base of the eyes; face broadly depressed

along scapes; clypeus twice as wide as long, immarginate, notched in

centre ; (lateral aspect), genal sulcus absent, cheek slightly shorter than the eyes, full ; eyes oval, very slightly narrowed ventrally ; (dorsal aspect), head twice as wide as long, wider than the thorax, slightly narrowed behind the eyes ; occiput immarginate, strongly concave ; ocelli arranged on an obtuse angled triangle, the distance of the lateral ocelli from the eye being about equal to that of the lateral ocelli from each other.

Thorax : Pronotum visible from above, not so wide as the mesonotum, slightly produced into a neck forward, length about half that of the mesonotum. Mesothorax slightly more coarsely reticulated than the remainder of the thorax ; parapsidal furrow distinct for half the length of the mesonotum, anterior margin rounded ; axillæ produced forward to a line drawn from tegula to tegula not meeting by half their width ; scutellum rounded, full, slightly more than half the length of the thorax ; post-scutellum narrow, strongly margined. Metathorax shorter than the scutellum, angular posteriorly ; spiracles broadly oval ; sulci absent ; lateral carinæ well marked ; median carina present ; articulation with abdomen high margined ; a distinct circular depression on either side and near to the articulation.

Abdomen : Broadly ovate, as long as thorax, greatest width at segments 3-4, subsessile ; ovipositor slightly exerted ; first visible segment the longest, about one and a half times as long as the second, the five following subequal.

Wings : Hyaline, submarginal vein slightly longer than one-third of the wing ; marginal vein the same thickness as the submarginal, as long as one-quarter of the wing ; postmarginal and stigmal veins short, subequal, the stigmal vein ending in a short knob, the knob having a short process directed towards the tip of the postmarginal vein.

Antennæ : Pubescent throughout, 13 jointed including the two ring-joints, the scape reaching almost to the median ocellus, moderately slender ; the pedicel one and a half times as long as any of the flagellar joints, obconic ; flagellar joints longer than thick, subequal, slightly and regularly clavate.

Mandibles : Brownish yellow, similar, each quadridentate.

Male.—Average length, 1.6 mm. Colour similar to female, reflections brighter green mixed with purple. Penis exerted. Antennæ shorter, more compact, joints of flagellum shorter than broad and more pubescent.

LIFE-HISTORY.

The development of the last and overwintering brood was studied. Females were observed ovipositing on September 13th. The time occupied in the process varied. A single female, which was isolated for observation, remained in the same position for $1\frac{1}{2}$ hours (see Fig. 20) with her ovipositor inserted in the cocoon. She then removed her ovipositor and walked away, moving about for twenty minutes, after which she returned and inserted her ovipositor in almost the same spot as before and remained in this position ovipositing for fifty-five minutes.

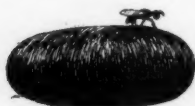


FIG. 20.—Female *C. nematocida* ovipositing on cocoon of *Lygaonematus erichsonii* Hartig, $\times 2\frac{1}{2}$.

In several instances two females were seen ovipositing in the same cocoon. The numerical abundance of the eggs that may be deposited in a single cocoon may be judged from the fact that in one case eighty-one eggs were counted on a single larva; in another case forty-seven pupæ and adults were contained in a single cocoon. The sawfly larvæ in cocoons in which the chalcids had deposited eggs appeared less active than those in uninfected cocoons; this may be due possibly to some paralyzing action on the part of the female when ovipositing.

The eggs are .3 mm. in length and transparently white. In shape they are ovally elongate, having one end broader than the other, and are slightly curved (Fig. 21). They are deposited externally upon the larva,

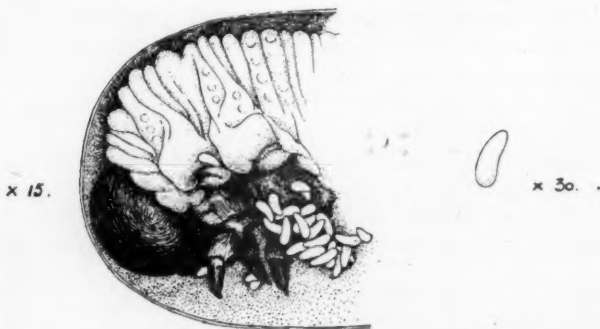


FIG. 21.—Interior of anterior end of cocoon of *L. erichsonii*, showing eggs of *C. nematocida* deposited on the sawfly larva, $\times 15$. Also single egg of *C. nematocida*, $\times 30$.

chiefly in the anterior and thoracic region and appear to be laid in masses

with no attempt at placing them, were this possible. In three days all the larvæ had hatched from eggs deposited by females on September 13th.

The larva, when newly emerged, is transparent and vitreous in appearance.

In the breeding experiments considerable difficulties were encountered owing to the prevalence of the entomophagous fungus, *Isaria farinosa* (Dicks) Fr., which repeatedly attacked the sawfly larvæ under observation. This caused the chalcid larvæ to cease feeding and leave the host usually one or two days before the fungus was observed. On this account no observations of a continuous nature could be made upon the same chalcid larvæ. Nevertheless, the observations were made upon larvæ which emerged from eggs all deposited on the same dates, namely, September 13th and 14th, on cocoons which were separated and kept under observation. They belonged, therefore, to the same series of larvæ, and the observations will be given as if they appertained to the same larvæ, which, under the circumstances, is permissible.

Sept. 18.—Two days after emerging from the eggs the larvæ were all
1910. feeding, being attached to the host larva by their heads in leech-like manner. For a day or two they did not appear to leave the place of original attachment.

Sept. 21.—Several larvæ had moved their positions, one being attached to the eye of the host larva.

Sept. 27.—Two larvæ from one of the cocoons left the cocoon and travelled one or two centimetres from the cocoon. They were replaced in the cocoon, but had evidently ceased feeding, although another larva in the same cocoon had its head still buried in the side of the host.

Subsequent observations and examination indicated that these larvæ were full grown. The larvæ may become mature, therefore, in about twelve days.

Oct. 9.—The larvæ were still in the cocoons, full grown and not feeding. They hibernate apparently as full-grown larvæ in the cocoons of the host.

Mar. 3.—Four of the hibernating larvæ had pupated, but several larvæ
1911. still remained unchanged.

Apr. 21.—Two adult chalcids emerged.

This would make the time of development of the over-wintering brood about seven months, under experimental conditions. Passing the

winter in this manner the parasite occupies that portion of the year, during which the climatic conditions would prohibit its activities in the way of attacking fresh cocoons, were it able to produce more broods.

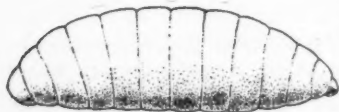


FIG. 22.—Full-grown larva of *C. nematocida*. $\times 12$.

The Larva.

The full-grown larva (fig. 22), measures 2.35 mm. in length. It is white, and the body, which consists of thirteen segments, has the

dorsal side more strongly convex. The larva feeds externally, usually with its head buried in the side of the host.

Number of Broods.

As it is not found possible in these experiments to follow the development of a single line of the parasites through the year, exact statements as to the number of broods during the season cannot be made at present. I believe, however, that it is safe to make inferences from the observations which were made on material collected in Massachusetts and in Canada. In one batch of cocoons, adults emerged on October 9th from cocoons in which eggs had been deposited on September 13th to 16th, from which it would appear that the time of development of a summer brood was about 23 days. It has been found that the females oviposit shortly after emergence, so that no lengthy period necessarily intervenes between the development of the broods if the parasite can find healthy cocoons of the sawfly.

The prevalence of healthy cocoons of the host would determine the efficiency of the parasite. It has been found in studying the life-history of the host *L. erichsonii* that the sawfly larvæ may become full grown and form the cocoons as early as June 12th to June 17th, which would mean that in any year cocoons of that year's sawfly larvæ could be found from the middle of June. Further, it has also been found that sawflies will continue to emerge from the cocoons of the larvæ of the previous year until the end of June, which indicates that there is a supply of the previous year's larvæ in their cocoons until the first or second week in June. In short, it has been found that cocoons containing larvæ of *L. erichsonii* may be found throughout the whole year, the time of least abundance being in June. It may be assumed, therefore, that if the Chalcid can find healthy cocoons, and this has been shown to be possible during the whole of the year, the production of broods may continue throughout that portion of the year during which the climatic conditions

permit the activity of the Chalcids. From my observations on the emergence of the Chalcids, this is from the latter part of May to the beginning of October, namely, about five months. On the basis of these facts, there is sufficient time for the development of about six broods during the open season; assuming that healthy cocoons are available on the emergence of the adult Chalcids. The cocoons are usually so located under the turf, as to be readily accessible to these small Chalcids, which, on emerging from one cocoon, would soon seek a healthy host. It would seem, therefore, from the study of the parasite and from such evidence as I have been able to collect concerning the history of the prevalence of its host in certain localities, that this species is one of the chief factors in the natural control of *L. erichsonii* wherever the Chalcid occurs.

* *Summary.*

In the observations which were made on the development of the Chalcid *Celopisthia nematocida*, it was found that in the September and October broods the eggs, which are laid on the host larvæ inside the cocoons, hatch in two to three days; the larvæ become full grown in ten to twelve days, and the adults may emerge about twenty-three days after the eggs were deposited. The parasite feeds externally and hibernates as a mature larva inside the cocoon of the host. A number of broods of the parasite occur annually.

ON THE HABITS AND STRIDULATION OF *IDIONOTUS*
BREVIPES CAUDELL, AND OTHER NOTES
ON ORTHOPTERA.

BY E. M. WALKER, TORONTO, ONT.

Since recording the capture of the northern Dectician, *Idionotus brevipes* Caudell, at Fort William, Ont. (CAN. ENT., XL, p. 209), I visited the same locality again in 1910, and succeeded in finding the insect a second time, on the second and eighth of August.

I found that it is by no means confined to open grassy places, as I had supposed, but occurs also in paths and old lumber roads in the depths of the spruce swamps, which still cover the greater part of the flat country surrounding Fort William and Port Arthur. The tree growth in these swamps consists mainly of black spruce, interspersed with tamarack, white cedar and balsam fir.

With the exception of a single female, which I found squatting close to the ground on a path in the swamp, all the specimens taken were males,

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and were all traced by their stridulation. When discovered, they were sometimes found perching in a conspicuous position upon the upper side of a leaf or twig of some shrub, a few feet from the ground, but several times the sound was traced to the trunk of a tree, and the musician was in some cases too high up to be detected. One was seen on the trunk of a black spruce, about twelve feet from the ground, and could just be reached with the net by standing upon a nearby stump.

The stridulation of this grasshopper is a soft trill of little volume, audible at a distance of but a few yards. It is sometimes continuous for some seconds, but is generally interrupted rhythmically, the divisions being produced at a rate varying according to the amount of sunshine. In bright sunshine I counted forty in fifteen seconds, the rate being thus $2\frac{2}{3}$ divisions per second, but on an afternoon when the sun was almost wholly overcast the rate was reduced to forty-one or forty-two in thirty seconds, or about half the rate in sunshine. When close to the stridulating insect I could detect that there were no absolute pauses between the trills, a very low trilling sound filling in all the intervals. The rhythm is not always quite regular. Sometimes after a succession of trills of apparently equal length one may be shortened or lengthened, and then the regular trilling resumed.

All the specimens of this insect seen were of the brachypterous form, with one exception, in which the tegmina and wings were similar to those of the macropterous individual figured on plate 7, CAN. ENT., *loc. cit.*

The stridulation of *Chlocaltis abdominalis* Thomas was also heard repeatedly at this locality, and can be fairly well represented by "zip-zip-zip" repeated continuously at a rate varying from five per second (late afternoon sun, nearly overcast), to a little over six per second (bright sunshine). Doubtless the rates in both these cases vary more than these observations show, it being a general rule among the Orthoptera that a lowering of temperature produces a corresponding retardation in the rate of stridulation.

Only one species of Orthoptera was taken in the vicinity of Fort William that was not observed here in 1908. This was *Nemobius fasciatus abortivus* Caudell. The specimens were confined to a small sandy area thinly clothed with grass and weeds. They were very small, and the stridulation was a low continuous trill, differing thus from that of typical *fasciatus*. It is thus possible that this form is specifically distinct.

NEW SPECIES OF EMPRIA.

I.—EASTERN SPECIES.

BY ALEX. D. MACGILLIVRAY, ITHACA, N. Y.

Empria cavata, n. sp.—Female. Clypeus uniformly flat or convex; antennal furrows broadly rounded depressions, continuous from the antennal foveæ to the lateral ocelli; the ocellar basin a broadly depressed area from near the antennæ to the median ocellus; the median fovea a minute pit; the ocellar and interocellar furrows wanting; the clypeus broadly, roundly emarginate; the third segment of the antennæ longer than the fourth; the saw-guides straight above and broadly rounded to a blunt point at apex above; the body black, with the labrum, tegulæ and the legs, except a spot on the outer margin of the coxæ, white. Length, 7 mm.

Habitat.—Oswego, N. Y. Mr. C. S. Sheldon, collector.

Empria callosa, n. sp.—Female. Clypeus uniformly flat or convex; antennal furrows linear, broadly interrupted on the middle of the front; the ocellar basin a distinct depression extending to the median ocellus; a linear depression with a distinct median fovea at its ventral end; the ocellar furrow indicated at middle, the interocellar furrow distinct; the clypeus moderately, deeply, angularly emarginate, with a low projection at middle; the third segment of the antennæ slightly longer than the fourth; the saw-guides straight above, convex below, narrowly, obliquely rounded at apex; the body black, with the clypeus, labrum, tegulæ, a line on the collar, the coxæ at apex, the trochanters more or less, the front femora, the middle and hind femora at apex, the front tibiæ and tarsi, the middle tibiæ at base and beneath and their tarsi, and the hind tibiæ at base, dirty white. Length, 7 mm.

Habitat.—Ithaca, N. Y.

Empria cetrata, n. sp.—Female. Clypeus uniformly flat or convex; antennal furrows linear, broadly interrupted on the middle of the front; ocellar basin a distinct depression extending to the median ocellus, with broadly sloping sides, with a deep, broad, median fovea at its ventral end; the ocellar and interocellar furrows distinct; the clypeus slightly biemarginate at apex, practically truncate; the third and fourth segments of the antennæ subequal; the saw-guides convex above, convex below, broadly, convexly rounded to a blunt point at the middle of the apex; body black,

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with the collar, tegulæ, base of the wings, and the legs, white. Length, 6 mm.

Habitat.—Ames, Iowa. Professor E. D. Ball, collector.

Empria celsa, n. sp.—Female. Clypeus uniformly flat or convex; the antennal furrows linear, broadly interrupted on the middle of the front; the ocellar basin wanting or at most indicated only adjacent to the median ocellus, the median fovea deep, with flaring sides; the postocellar area and the dorsal margin of the head polished; the region of the ocellar furrow flattened; the ocellar and interocellar furrows distinct; the clypeus angularly emarginate, the lobes broadly rounded; the third segment of the antennæ longer than the fourth; the saw-guides with the upper and lower margins parallel and truncately rounded at apex; the body black, with the clypeus at sides, the labrum, the tegulæ, collar, wings at base, and the legs beyond the apices of the coxæ, except the front and middle femora more or less beneath, the hind femora in great part, and the hind tibiæ at apex, white. Length, 6 mm.

Habitat.—Ithaca, N. Y.

Empria callida, n. sp.—Female. Clypeus with a median carina; ocellar basin dumb-bell-shaped, constricted to a mere line at middle, broad, pit-like adjacent to the median ocellus; the median fovea an elongate pit; the antennal furrows interrupted on the middle of the front; ocellar and interocellar furrows distinct; the clypeus emarginate, with a distinct tooth at middle; the third segment of the antennæ longer than the fourth; the saw-guides with the upper margin straight, the lower margin converging, and broadly, obliquely rounded at apex; the body black, with the labrum, clypeus, collar, tegulæ, base of the wings, and the legs beyond the apices of the coxæ, white. Length, 6 mm.

Habitat.—Ithaca, N. Y.

Empria cava, n. sp.—Female. Clypeus with a median carina; clypeus with a broad, convexly rounded median ridge, occupying almost one-third of the width of the clypeus; the antennal furrows interrupted on the middle of the front; the median tooth of the clypeus distinctly shorter than the lateral lobes, the lateral lobes broadly rounded; the ocellar furrow linear, the interocellar furrow broad and distinct; the third segment of the antennæ almost as long as the fourth and fifth together; the saw-guides convex above and below, slightly, obliquely rounded at

apex; the body black, with the collar, tegulæ, front and middle legs below the knees, and the hind tibiæ beneath, white. Length, 6 mm.

Habitat.—Lancaster, N. Y. Mr. M. C. VanDuzee, collector.

Empria calda, n. sp.—Female. Clypeus with a median carina; clypeus shallowly, angularly emarginate, almost truncate, with a small but distinct tooth, the lateral lobes angularly rounded; the ocellar basin extending to the median ocellus; the median fovea a rounded pit opposite the dorsal margin of the antennal foveæ, the front not strongly produced between the antennæ; the ocellar and interocellar furrows deep and distinct; the third segment of the antennæ slightly longer than the fourth; the saw-guides slightly concave above, convex below, broadly rounded to a blunt point at middle of apex; the body black, with the labrum, collar, tegulæ, the front and middle legs below the apex of the femora, and the basal third of the hind tibiæ, white. Length, 6 mm.

Habitat.—Durham, N. H. Mr. J. C. Bridevell, collector.

Empria cata, n. sp.—Male. Clypeus with a median carina, distinctly but shallowly, roundly emarginate, with a minute tooth, the lateral lobes acute; the ocellar basin extending to the median ocellus; the median fovea a pit opposite the middle of the antennal foveæ; the front strongly produced between the antennæ; the ocellar and interocellar furrows distinct; the third and fourth segments of the antennæ subequal; body black, with the collar and tegulæ white; the front and middle legs beyond the basal third of their femora and the hind legs beyond the apical fourth of their femora yellowish infuscated. Length, 6 mm.

Habitat.—Mt. Washington, N. H. Mr. W. F. Fisk, collector.

Empria caprina, n. sp. Male and female. The ocellar basin extending beyond the median fovea to the middle of the antennal foveæ and dorsally to the median ocellus; the supraclypeal area elevated; the median fovea but little deeper than the ocellar basin; the front strongly produced between the antennæ; the ocellar furrow only faintly indicated, the interocellar furrow distinct; the clypeus deeply, roundly emarginate, with a minute tooth at middle, the lateral lobes angular; the third segment of the antennæ longer than the fourth; the saw-guides convex above, straight below, and broadly rounded at apex; with the clypeus, labrum, tegulæ, collar, and legs beyond the coxæ, white. Length, 7 mm.

Habitat.—Ithaca, N. Y.

Empria casta, n. sp.—Female. Clypeus with a median carina, broadly, shallowly, roundly emarginate, with a low, broadly rounded tooth at middle, the lateral lobes rounded; the ocellar basin extending to the median ocellus, narrow and linear, ending ventrally in a pit-like median fovea, but little if any wider than the ocellar basin; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw-guides gradually converging on upper and lower margins, and broadly, roundly pointed at apex; the body black, with the margin of the clypeus, labrum, line on the collar, tegulæ, front and middle legs below the coxæ (except infuscation on the middle of the femora), hind trochanters, tip of hind femora, base of hind tibiæ, and base of their tarsi, white. Length, 7.5 mm.

Habitat.—Salineville, Ohio; male, Phoenix, N. Y.

Empria celebrata, n. sp.—Female. Clypeus with a median carina, broadly, shallowly, roundly emarginate, with a low broad tooth at middle, with broadly rounded lobes; ocellar basin rather broad, broader near the median fovea, the median fovea a broad crater; the ocellar furrow indicated, the interocellar furrow broad and distinct; the third segment of the antennæ distinctly longer than the fourth; the saw-guides convex above, straight and converging to the roundly truncated apex; the body black, with the clypeus, labrum, collar, tegulæ, trochanters, the front legs below the middle of the femora, the middle and hind legs beyond the knees, the apex of the hind tibiæ and the hind tarsi more or less infuscated, white. Length, 7 mm.

Habitat.—Buffalo, N. Y. Mr. E. P. VanDuzee, collector.

Empria captiosa, n. sp.—Female. Clypeus with a median carina, with a small, acutely pointed tooth at middle; the ocellar basin broad, with sloping sides; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw-guides convex above and below, broadly, convexly rounded at apex, the extreme apex truncate for a short distance; the body black, with the clypeus, labrum, collar, tegulæ, and legs below the knees, white. Length, 6 mm.

Habitat.—Ames, Iowa. Professor E. D. Ball, collector.

Empria ceca, n. sp.—Female. Clypeus with a median carina, angularly emarginate, with broadly rounded lobes, and with a broadly rounded median tooth; the supraclypeal area narrow and carinately elevated; the median fovea an elongate pit, with flaring sides at the

ventral end of the ocellar basin; the ocellar furrow indicated, the inter-ocellar furrow distinct; the third segment of the antennæ distinctly longer than the fourth; the saw-guides parallel above and below, and rounded at apex; the body black, with the clypeus, labrum, tegulæ and collar narrowly white; the legs more or less infuscated. Length, 6 mm.

Habitat.—Ithaca, N. Y.

Empria cariosa, n. sp.—Female. Clypeus with a median carina, deeply, narrowly, angularly emarginate to near the middle of the clypeus; the supraclypeal area rather broad and convexly elevated; the clypeal lobes roundly pointed and the median tooth small but distinct; the ocellar and interocellar furrows distinct; a depressed area in front of the median ocellus; the third segment of the antennæ distinctly longer than the fourth; the saw-guides with the upper and lower margins parallel and broadly, truncately rounded at apex; body black, with the clypeus, labrum, collar, tegulæ, front and middle legs beyond the apices of the coxæ, the base of their femora more or less infuscated, the hind trochanters, tibiæ and tarsi, sometimes infuscated, white. Length, 7 mm.

Habitat.—Slatterville—Caroline, N. Y.

Empria cauduca, n. sp. Clypeus with a median carina, truncate at apex; the antennal furrows adjacent to the antennal foveæ well marked; the ocellar furrow linear, distinct; the interocellar furrow broad and deep; the third segment of the antennæ distinctly longer than the fourth; the saw-guides convex above and below, broadly converging to a blunt point just above the middle of the apex; the body black, with the front and middle legs below the middle of the femora and the base of the hind tibiæ ringed with white. Length, 7 mm.

Habitat.—Ithaca, N. Y.

Empria castigata, n. sp.—Female. Clypeus with a median carina, the median tooth almost as long as the lateral lobes, all angular, the clypeus appearing tridentate; the interocellar furrow only extending to the median ocellus, forming only the stem of a Y; the median fovea only a rounded scar; ocellar and interocellar furrows linear, deep; the third and fourth segment of the antennæ subequal; the saw-guides convex above and below, and slightly, obliquely rounded at apex, the lower angle more rounded than the upper; the body black, with the collar, tegulæ, front and middle femora beneath at apex, front tibiæ, middle tibiæ beneath, and a ring at the base of the hind tibiæ, white. Length, 6 mm.

Habitat.—Battle Creek, Mich. Professor J. M. Aldrich, collector.

Empria casca, n. sp.—Male. Clypeus with a median carina, a small median tooth, and the lateral lobes rounded; the interocellar furrow extending each side of the median ocellus, forming an inverted Y-shaped furrow; the median fovea a wedge-shaped depression; the ocellar furrow faint; the postocellar area with a median furrow; the antennæ with the third and fourth segments subequal; body black, with the collar, tegulæ, apical half of the front and middle femora, their tibiæ, and the knees of the hind legs, all more or less infuscated, white. Length, 6 mm.

Habitat.—New Haven, Conn. Dr. W. E. Britton, collector.

Empria evecta, n. sp.—Female. Clypeus with a median carina, the median tooth short, the lateral lobes broadly angular; the interocellar furrow extending each side of the median ocellus, forming an inverted Y-shaped furrow; the median fovea a broad pit with flaring sides; the ocellar furrow linear; the saw-guides convex above and broadly, convexly rounded below and at apex to a blunt point; the body black, with a line on the collar, the apex of the front and middle femora, their tibiæ, and the basal third of the hind tibiæ, white. Length, 6 mm.

Habitat.—Sandy Hook, N. J.

Empria candidula, n. sp.—Female. Clypeus with a median carina, narrowly, deeply emarginate; with a small median tooth and carina, the lobes broadly angular; the median fovea of moderate size, with perpendicular sides, except in front, strongly flaring; a triangular shaped pit in front of the median ocellus; the ocellar furrow fine, the interocellar furrow broad; the saw-guides straight above, straight below and converging to apex, apex with angles broadly rounded and square at middle; body black, with the clypeus, labrum, collar, tegulæ and legs below the knees, tibiæ and tarsi more or less infuscated, white. Length, 6 mm.

Habitat.—Ithaca, N. Y.; Algonquin, Ill. W. A. Nason, collector. No. 5829.

Empria canora, n. sp.—Female. Clypeus with a median carina, broadly emarginate; the postocellar area longitudinally carinate at middle; the ocellar furrow faint, the interocellar furrow distinct; the third segment of the antennæ longer than the fourth; the saw-guides convex above and below, convexly and slightly obliquely, truncately rounded at apex; the body black, with the clypeus, labrum, collar, tegulæ, the front

and middle legs below the coxæ, the femora more or less infuscated, the hind trochanters, and a ring on the base of the hind tibiæ, white. Length, 6 mm.

Habitat.—Sherborn, Mass., Mr. A. P. Morse, collector; Connecticut, Mr. W. A. Nason, collector. No. 5829.

Empria cauta, n. sp.—Female. Clypeus with a median carina, angularly emarginate, with angular lobes; postocellar area not carinate; the ocellar basin wanting, the median fovea a pin-hole pit; the ocellar and interocellar furrows faint; the third segment of the antennæ longer than the fourth; the saw-guides convex above and oblique below, roundly truncated at apex; the body black, with the clypeus, labrum, collar, tegulæ, front and middle trochanters, and the hind tibiæ and tarsi, white. Length, 6 mm.

Habitat, Ithaca, N. Y.

(To be continued)

DANIEL WILLIAM COQUILLET.

A gap in the ranks of active entomologists and a feeling of personal loss to all who knew him has been created by the death of Mr. D. W. Coquillett, of the United States Bureau of Entomology and National Museum, who died at Atlantic City on July 8th.

In systematic entomology he had a knowledge of Diptera as wide as it was unique; in economic entomology he has the credit of being the first to discover and demonstrate the value of hydrocyanic acid gas as an insecticide.

Born in 1856, near Woodstock, Ill., we find him in 1880 contributing an article on "Larvæ of Lepidoptera" to Prof. Cyrus Thomas's Tenth Illinois Report, and a "Report on the injurious insects of Northern Illinois" to the Illinois State Entomologist's Report of the following year. In 1881 he became assistant to the State Entomologist of Illinois. Later, on account of his health he removed to Los Angeles, California, and while there he joined the staff of the United States Bureau of Entomology, in 1885, as field agent in the work on the Scale *Icerya purchasi* Mask. The results of this work during the succeeding two or three years were of such a nature as to secure for him a singular distinction as an economic entomologist. He communicated to Prof. W. G. Johnson the circumstances attending his chief discovery. "During the summer of 1886," he wrote, "I was employed by the United States Department of Agriculture to carry on a series of experiments at Los

Angeles, California, against the Cottony Cushion Scale (*Icerya purchasi*), but owing to an insufficient appropriation I was laid off on August 1st of that year. As no perfect remedy at that time had been discovered, I determined to experiment with gases in a private capacity, at my own expense. Accordingly, during the first week of the following month I began experimenting with hydrocyanic acid gas, which I thought would be the best for the purpose, owing to its very poisonous qualities, the rapidity of the generation and the readiness with which it diffuses itself in the air. Nobody suggested to me to try this gas. It was not until the following July that the Department of Agriculture again placed me on its rolls." Dr. Howard has called my attention to the fact that Mr. Coquillett had entire charge in California of the first importations of the parasites of *Icerya purchasi* which were sent over from their native haunts in Australia by Mr. Koebele and were received, bred and distributed by Mr. Coquillett. He received the first importations of *Novius (Vedalia) cardinalis* in 1887 and in the following year commenced to distribute this important Coccinellid enemy of the Scale. He acted as field agent of the United States Bureau of Entomology until 1893 when he joined the staff of the Bureau and he remained an active member of it until his death.

In 1896 he was made Honorary Custodian of the Diptera in the United States National Museum and this was only in accordance with the nature of his work which was now of a systematic character. His knowledge of the Diptera of North America and his intimate acquaintance with the very diverse families of this difficult order, to which his published works testify, gained for him not only a continental but a world-wide reputation. Students of North American Diptera will feel his loss exceedingly.

His connection, as a contributor, with THE CANADIAN ENTOMOLOGIST is of more than ordinary interest, as he contributed, I believe, more papers to this journal than to any other scientific periodical. A paper "On the early stages of some Moths," published in 1880, in Volume 12, was one of his earliest scientific papers; it may have been his first. His first paper on Diptera was "On the early stages of the Dipterous Fly *Chrysophila foeda* Loew.," published in 1883, in Volume 15. His last contribution was made in February last, and I have a happy recollection of a conversation I had with him when visiting Washington in April. Little did I think that we should be deprived so soon of one who for over thirty years had contributed to these pages, and was ever ready to assist us in the study of Canadian Diptera.—C. GORDON HEWITT.

TACHINIDÆ, NEW AND OLD.

BY W. R. THOMPSON, ITHACA, NEW YORK.

(Continued from Vol. XLIII, p. 272.)

Acronarista mirabilis Town.

This species was described by Mr. Townsend (in Tax. Musc. Flies, p. 86), from a single specimen collected by Dr. H. G. Dyar at Palm Beach, Fla. The type specimen seems to be a male, not a female. In the genus *Schizotachina* and related genera, of which this is one, the secondary sexual characters, such as holopticism, the absence of orbital bristles, and long claws and pulvilli in the male sex, are not apparent. The only certain method, therefore, of determining the sex of a specimen is by an examination of the genitalia. The close relation of the genus *Acronarista* to *Schizotachina* would seem to indicate that the incised third antennal segment is in itself likely to be characteristic of the male sex, and an examination of the genitalia of *Acronarista* has confirmed this view.

The males of the two genera may be separated as follows :

- Arista inserted at two-thirds the distance from base to apex of third antennal segment ; palpi cylindrical, quite small. *Acronarista* Town.
 Arista inserted close to the base of the third antennal segment ; palpi well developed, often more or less broadened and flattened. *Schizotachina* Walk.

Metopia Meigen.

Among a number of Tachinids collected in the neighbourhood of Boston, Mass., I found a number of specimens which I at first thought to be females of *Metopia leucocephala* Rossi. An examination of the genitalia, however, showed that both sexes were present, and upon more careful study I found good characters for the separation of both males and females from those of *leucocephala*. The specimens were submitted to Mr. Coquillett, who determined them as *Metopia lateralis* Macquart. This species was described by Macquart in Dipt. Exot., Sup. III, p. 208 (48), 1847, as *Degeeria lateralis*. The species was placed by Mr. Coquillett as a synonym of *M. leucocephala* in his "Revision." Only females were in the U. S. N. M. collection, and these differ so little from the females of *leucocephala* that their separation did not seem warranted. The species may be separated by the following key :

1. Frontal vitta and parafrontals dark brown on posterior half, somewhat polished, parafrontals very thinly dusted with silvery-pollen on the anterior half and apparently including the frontal vitta, shining

silvery-white; the parafrontals converge rapidly from the vertex, meeting at the line separating the posterior and anterior halves of the front, the triangular frontal vitta apparently ending acutely at that point, continued to the base of the antennæ as a scarcely perceptible median line separating the parafrontals, which almost fusing along this line form a median carina on the anterior half of the front; parafacials and cheeks silvery; the rows of cruciate frontal bristles interrupted across the anterior half of the front, from the apex of the frontal vitta to the base of the antennæ; a row of six or seven upwardly curving bristles extend from the base of the antennæ to a point a little below the arista; front projecting in front of the eye a distance about equal to the horizontal diameter of the latter as seen from the side; front narrowest at vertex, broadening anteriorly; the inner margin of the eye, as seen from in front, concave, more distant at middle than below; legs black, sides of the abdomen not reddish-tinged; third abdominal segment with only two median marginal macrochætæ. Male.....*M. leucocephala* Rossi.

Frontal vitta dark brown, sometimes dusted with silvery pollen, but diminishing only slightly in width from vertex to base of antennæ, parafrontals never approximated on anterior half of front to form a median carina; front flat, parafrontals widely separated from vertex to base of antennæ; the rows of cruciate frontals not interrupted on the anterior half of the front; parafacials and cheeks thickly silvery-white pollinose.....2.

2. Front projecting in front of eyes a distance equal to three-fourths the horizontal diameter of the eye, as seen from the side; frontal vitta from one-fourth to one-third the width of the front; frontal vitta dark brown, sometimes thinly dusted with whitish pollen, at times wider at vertex than on the anterior part of the front, parafacials never approximated to form a median carina, the front flat; legs black; abdomen not reddish-tinged; third abdominal segment with only two median marginal macrochætæ. Female...*M. leucocephala* Rossi.

Front projecting in front of eyes a distance equal to one-fourth to one-third the horizontal diameter of the eye, as seen from the side; frontal vitta from one-half to three-fifths width of front; front broadest at vertex, narrowing anteriorly; the inner margin of eye, as seen from in front convex, more distinct below than at middle; legs and sides of abdomen often largely reddish; third abdominal segment with a row of 6 or 7 strong marginal macrochætæ.....*M. lateralis* Macq.

Gediopsis Brauer and von Bergenstamm.

I have been unable to determine certainly whether any of the specimens in the U. S. N. M. collection are referable to *mexicana* B. and B. I find that the specimen originally determined as *mexicana* by Mr. Coquillett (in "Revision of Tachinidæ," p. 136), is identical with specimens described by him later under the name *ocellaris* (in Proc. U. S. N. M., XXV, 118). The specimens which he subsequently determined as *mexicana* have been separated by Mr. Townsend into two species, *sierricola* Towns. and *organensis* Towns., which he described as new in the "Taxonomy of the Muscoidean Flies," p. 93. It is very difficult to say which of these forms is the true *mexicana*, and pending comparison of specimens with the type the names may as well be left as they are. Mr. Townsend's two species are, at all events, exceedingly closely allied, but a larger series is necessary in order to determine the limits of variability of the species.

The genus *Poliophrys*, proposed by Mr. Townsend (*loc. cit.*, p. 90), for these species, certainly cannot be maintained in view of their undoubted close relationship to *mexicana*, which is the type of *Gediopsis*. Mr. Townsend gives no characters for the separation of his genus from *Gediopsis*, and I have been unable to discover any.

The following key to the North American species, based upon the specimens in the U. S. N. M. collection, may be of service. The type specimen of *Gediopsis monticola*, described by Mr. Townsend from one male specimen collected in the Organ Mts., New Mexico, has been examined by Mr. Coquillett, who informs me that it is the same as *setosa* Coq.

1. Legs black or tinged with rufous, at most with the tibiæ reddish . . . 2.
 Legs, except the tarsi, yellow; tarsi dark brown; first abdominal segment without marginal macrochætæ; no ocellar bristles; third arisal segment from about one and one-half (males) to about three times (females) the length of the second segment; several macrochætæ and a number of strong bristly hairs on the parafacials. Length, 7.5 mm. *G. flavipes* Coq.
2. Third arisal segment not over one and one-half times the length of the second segment; parafacials without macrochætæ or strong bristly hairs, near the lower corner of the eye on the outer part of the parafacials with only a cluster of fine hairs, which extend along the parafacials for less than one-half of the distance from the level of the vibrissæ to the lowest frontals; with one or two similar fine hairs below the lowest frontals; parafacials otherwise bare; ocellar bristles strong; fourth segment of the abdomen, except the base, red,

somewhat polished, thinly grayish-pollinose; only marginal macrochætæ on second and third abdominal segments, none at all on first segment. Cheeks not over one-fourth the height of the eye. Length, 9 mm. *G. facialis* Coq.*

Third arisal segment not less than twice the length of second segment; parafacials with a row of macrochætæ or strong bristly hairs, and between these and the eye rows of weaker hairs, these extending from the cheeks up to the lowest frontals. Ocellar bristles present or absent. First abdominal segment bearing marginal, remaining segments bearing marginal and sometimes discal macrochætæ. . . . 3.

3. Abdomen and mesonotum grayish pruinose or pollinose; the mesonotum with darker vittæ, the abdomen with dark-reflecting spots. . . . 4.

Abdomen, as viewed from above, dark brown, somewhat polished, without grayish pruinosity or pollinosity; mesonotum, as seen from above, thinly grayish-dusted, with darker vittæ only on the anterior part, the remainder of the mesonotum and the scutellum appearing somewhat polished, the scutellum dark reddish; first two abdominal segments on the sides reddish, the first three segments with strong marginal macrochætæ, the second and third with short erect bristles, intermingled with which are sometimes discal macrochætæ; ocellar bristles present or absent; species having a superficial resemblance to *Blepharipeza leucophrys* Weid. Length, 11 mm. *G. cockerelli* Coq.

4. Second and third abdominal segments with discal macrochætæ. . . . 5.
Second and third abdominal segments without discal macrochætæ. . . . 6.

5. Ocellar bristles not developed; sides of front more or less strongly tinged with reddish, in certain lights appearing somewhat polished, thinly pruinose; scutellum red, polished, thinly grayish-dusted; abdomen in the male with the sides broadly reddish, the fourth segment black or reddish tinged, somewhat polished, only thinly grayish-dusted, second and third segments with strong discals in both sexes. Length, 12 mm. *G. setosa* Coq.
Ocellar bristles developed, strong, proclinate; sides of the front opaque, densely yellowish-pollinose; scutellum blackish at base, only slightly

*In the single specimen of this species (the type, male) in the U. S. N. M. collection, only the large scars of the ocellar bristles remain. That the specimen once possessed well-developed ocellar bristles there can be no question; in the description of the species, however, nothing is said in regard to the direction of the bristles, so that it is not certain that they were present when the specimen was received by Mr. Coquillett. In view of this fact and the singular divergence from the typical generic character presented by this species in the almost bare parafacials, its generic position must remain to a certain extent in doubt until perfect specimens are secured.

- polished, grayish-pruinose; sides of the abdomen only very slightly reddish tinged, fourth segment densely yellowish-pollinose, not polished, the colour of that segment contrasting somewhat with the colour of the remainder of the abdomen, which is more bluish-gray; second and third segments in the male each with a pair of weak discals, in female there is but one of these on the second and a pair on the third segment. Length, 9 mm. *G. sierricola* Town.
6. No well-developed ocellar bristles; fourth abdominal segment densely covered with yellow pollen, its colour contrasting strongly with that of the remainder of the abdomen, which is bluish; face and front like fourth abdominal segment, yellowish-pollinose, and when viewed from the side a brown-reflecting spot of greater or less extent appears below the lowest frontal bristles. Length, 9 mm. The species superficially resembles *Exorista futilis* O. S. *G. ocellaris* Coq. Ocellar bristles strong, proclinate. 7.
7. Fourth abdominal segment concolorous with the preceding segments; the abdomen grayish, brassy-pollinose, with blackish reflections; parafacials densely bluish-pollinose, the pollen of the front slightly tinged with golden. Length, 8-10 mm. *G. organensis* Town.
- Fourth abdominal segment yellowish-pollinose, its colour contrasting somewhat with the remainder of the abdomen; second and third abdominal segments with weak discal macrochaetae; pollen of face and front yellowish. Length, 9 mm. (See under No. 5). *G. sierricola* Town.

Mr. Coquillett has kindly furnished me with the locality records for these species, which are as follows:

- G. flavipes* Coq.—Tifton, Ga., and Opelousas, La.
G. facialis Coq.—Georgia (type).
G. cockerelli Coq.—White Mts. (type), and Las Cruces, N. Mex.; Chisos Mts., Brewster Co., Texas, and Sierra Madre, Chihuahua, Mex.
G. setosa Coq.—Siskyou Co., Cal. (type); White Mts. and Rio Talarosa, N. Mex., and Sierra Madre, Chihuahua, Mex.
G. sierricola Town.—Sierra Madre, Chihuahua, Mex.
G. ocellaris Coq.—Ohio (type); Angora Fern Rock and Philadelphia, Pa., and Franconia, N. H.
G. organensis Town.—Organ Mts., New Mexico (type).

From these records it seems that *ocellaris* is a northeastern species, *flavipes* and *facialis* are southern central forms, and all the others are southwestern species.

ON *CEA IMMACULA* AND ALLIED SPECIES.

BY WM. BARNES, M.D., AND J. MCDUNNOUGH, PH.D., DECATUR, ILL.

In sorting over material from Arizona and the southwest we have come across four species very similar in outward appearance, but structurally widely different. Two of the species are fairly well known, but the other two are apparently undescribed.

The first species before us is *immacula* Grt.; (not *immaculata* as given in Dyar's List), the type of the genus *Cea*. The species was originally described from Arizona, but our series of some twenty specimens all come from Deming, N. Mex. It may be recognized by its immaculate creamy-white primaries, which in very few cases show faint traces of t. a. and t. p. lines and reniform. The legs are unarmed, with neither spines nor claws; the front possesses a fairly prominent rounded protuberance with a distinct corneous infra-clypeal plate. According to Hampson (Cat. Lep. Phal., IX, 280), who, however, does not know the species personally, the protuberance is bare of scales; this, however, does not apply; with the exception of a small black point in the centre of the same, it is thickly covered with closely-appressed scales, of a slightly darker ochreous tint than that of the surrounding area.

The second species under consideration is *luxa* Grt., described from specimens taken by Prof. Snow in N. Mexico, and made by Grote the type of a new genus, *Bessula*. In Dyar's Catalogue this species is placed close to *immacula*, but Hampson separates it very widely, placing it at the very beginning of the *Noctuidæ* in his subfamily *Agrotinæ*, characterized by spined tibiæ of middle and hind legs; *luxa* is placed in the genus *Schinia* Hbn., of which *Bessula* is made a synonym. Besides spined middle and hind tibiæ, *luxa* possesses on the fore tibiæ a strong curved claw on the inner side, preceded by two minute spines, which often appear wanting, owing probably to breakage; further, on the outer side of the tibiæ, is a row of three claw-like spines, the largest being at the extremity of the joint. The front is rounded, scarcely as full as in *immacula*, with appressed scales without the central black point, and the infra-clypeal plate is present. In general appearance *luxa* is yellower than *immacula*, and may at once be distinguished by the light-brown dotted t. p. line, the cellular dots and the dots at the base of the fringes. As in many cases these show a tendency to obsolescence, structural characters are of great value in separating the species. The sixteen specimens before us are from So. Arizona.

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The third species is at first sight very easily confused with *luxa*; a glance at the tibiae will suffice, however, to separate it, for they are all unarmed, as in *immacula*. The front has a large corneous heart-shaped process with raised edges and the infra-clypeal plate is very distinct. Although differing considerably in outward appearance from the species at present included therein, it seems to belong in the genus *Oslaria* Dyar. As it appears to be undescribed, we would propose the name *pura* for it, and append following description:

Oslaria pura, n. sp.

Front, thorax, abdomen and primaries creamy-white; t. a. and t. p. lines faintly outlined in brown; the former from costa at $\frac{1}{3}$ from base, irregularly dentate, with two darker brown dots at intersections of median and anal veins; the latter well beyond reniform, midway between it and outer margin, parallel with margin, slightly dentate and with darker brown dots at intersection of veins; orbicular and reniform outlined in brown; former small, round; latter large, constricted in middle, and connected with inner margin by faint brown shade; on costa between orbicular and reniform a slight brown shade; fringes but slightly darker than wings; secondaries pure white.

Beneath white shaded with brown towards apex of primaries and with indistinct postmedial band on same. Expanse, 28 mm. Described from 5 ♂s, 10 ♀s. Christmas, Gila Co., Ariz. Types, Coll. Barnes.

The above description was made from a clearly-marked specimen. There is a great tendency for the maculation to become indistinct, especially in the males, leaving only the dots at intersection of veins distinct. In one ♀ specimen there are traces of a dotted median line on secondaries.

The fourth and last species belongs in the group with unarmed tibiae; its frontal structure is that of the genus *Lythrodus* Sm., consisting of a corneous protuberance with raised edges, containing a prominent vertical plate; infra-clypeal plate is present; the fore tarsi are also shot, with large terminal claws, agreeing in this respect with Smith's characterization of the genus. It differs greatly from *L. radiata* and *venosa*, but seems to approach more closely *semiluna* Sm. in general appearance. We propose to call it *tripuncta*, with following description:

Lythrodus tripuncta, n. sp.

Head, thorax and wings white, primaries suffused with light brown, especially in median and subterminal areas. A small brown basal dot,

situated in slight brown shade; t. a. line broad, brown, angled twice inwardly, almost straight across wing; t. p. line brown, slightly dentate in upper portion, strongly outcurved just below costa, incurved somewhat opposite reniform, strongly incurved below same to inner margin, where a slight outward angle is formed; orbicular represented by a brown dot; reniform by two brown dots, situated at either extremity, placed vertically to each other; from just beyond orbicular to t. p. line the median area is largely suffused with light brown; beyond the t. p. line is a narrow band of white, the remainder of the subterminal area washed with brown; subterminal line represented by a white, irregular, dentate band, beyond which the brown shading again obtains; fringes white, tinged with brown at extremities. Secondaries white.

Beneath primaries smoky-brown, whitish along inner margin; secondaries white, tinged with brown along costal margin and with traces of a brown postmedial line. Expanse, 28 mm.; 2 ♂s, 2 ♀s; Redington, Ariz.; Babaquivera Mts., Ariz. Types, Coll. Barnes.

The three brown dots representing respectively orbicular and reniform are quite characteristic. The ♂ specimens are in very poor shape, but the ♀ is well preserved; the description has been drawn from the latter.

PREDACEOUS BUGS.

A very remarkable occurrence of predaceous bugs has taken place in Southwestern Ontario during the last few weeks. Correspondents in the counties of Dufferin, Norfolk, Oxford and Middlesex have sent in specimens of *Perillus bioculatus* Fabr., and of its variety, *claudus* Say. The latter form was described and figured in the Second Annual Report of the Entomological Society of Ontario, published in 1871, under the name of *Perillus circumcinctus*. These bugs, both in the imago and nymphal forms, are destroying the Colorado Potato Beetles, both eggs, larvæ and mature beetles, to such an extent that in some fields it is reported that hardly any of the beetles are to be found, though the plants have not been sprayed. They are quite abundant also at the College in Guelph and other parts of the County of Wellington. The specimens have been kindly identified by Mr. E. P. Van Duzee, of Buffalo, N. Y. He expresses surprise at the species being found in this part of Ontario, as he considers it a southern form, and is rarely known to be found as far north as the State of Illinois. It is to be hoped that the insect may continue prevalent and keep the Colorado Potato Beetle in control.—[C. J. S. BETHUNE.

ERRATUM.—P. 286, line 7, for "*poliachroa*" read "*poliochroa*."

FURTHER NOTES ON ALBERTA LEPIDOPTERA.

BY F. H. WOLLEY DOD, MILLARVILLE, ALTA.

(Continued from page 286.)

186. *O. cibalis* Grt.?—Sir George Hampson makes the Calgary form "Subspecies 1 of *cibalis*, describing it by comparison: Thorax and fore wing grayer, the latter more uniform, and without the whitish patches in the interspaces; the dentate black marks before subterminal line more developed between veins 6 and 2; tegulæ produced to a dorsal ridge." He figures as typical *cibalis* a male from Glenwood Springs, Colo. The figure shows a strong rufous brown shade over a large portion of the primaries, which, however, he does not mention in the description. I compared the specimen with his figure, and made no criticism upon the latter. Moreover, I have a good series from Eureka, Utah, which fit the figure perfectly.

My note on Prof. Smith's material reads: "Utah and Colo. specimens are more pale streaked than my form, but one from Colo. grades in." This is in accordance with Hampson's diagnosis, nor do I seem to have observed brown shades shown in his figure and in my Eureka series. At Washington I wrote: "One 'Colo.' and one 'Glenwood Springs' are like Hampson's figure. But two Denver males, one of them labelled 'W. S. Foster,' are exactly like Calgary specimens here, and I should say these are almost certainly two species." My own Calgary and Utah series suggest the same, very strongly. But which is *cibalis* remains to be discovered, as I have not seen Grote's description, and the type, which Prof. Smith's Catalogue states to be from Colorado, and in the Graef. collection, I appear to have overlooked. Holland's figure represents the Calgary form (which also occurs in Manitoba) exactly. The origin of the specimen figured can only be surmised by his statement on page 176: "The only specimens so far have been taken in Colorado."

187. *Rhynchagrotis gilvipennis* Grt.—Prof. Smith in his "Revision of Agrotis" places *gilvipennis* first in his then new genus *Rhynchagrotis*, considering it, it is to be supposed, the most typical, making our species a synonym of *chardinyi* Bdv. He remarks on page 14: "Mr. Grote first stated that the fore tibiæ in his specimens were spinose, but I have never been able to discover any." In his reference to *chardinyi* he merely follows Morrison and Grote. In his Catalogue he corrects this and makes *gilvipennis* a good species. Sir George Hampson places most of our species of *Rhynchagrotis* in *Triphana* Hübn., but retains Smith's genus for

chardinyi and *gilvipennis* exclusively, describing it, as Smith did, as a genus having unspined fore tibiae, and quoting *gilvipennis* as the type. He had only three specimens of this at the time of publication, including the male type from Anticosti, which is well figured. I did not examine the specimens structurally. Recent investigation has disclosed the fact that, at Calgary at least, fore tibial spines are quite frequent in this species. In two of my specimens I can, without recourse to laying the vestiture, easily see five spines on the inner side. In many others I can find from one to five, with varying degrees of prominence, though in some I can find no trace of any, even by laying the hairs with gasoline or alcohol.

I have only two specimens of European *chardinyi*, and can detect no spines on fore tibiae of these, though they will require careful re-setting before they can be examined to advantage.

I have not yet investigated very fully in other species referred by Prof. Smith to this genus, but have succeeded in discovering a single spine on the fore tibiae of two Kaslo specimens out of a series of *confusa*, beneath, and just in front of the epiphysis.

Within the past year I have observed enough about the apparent occasional variability of tibial spines to make me desirous of a more thorough investigation. In order to do this, I should like to discover some effective method of entirely removing hairs and scales without injury to spines or spurs. I shall be very grateful for advice on this subject (*vide* recent exchange notice). The matter is important, as some genera as used by Sir George Hampson rely, for their existence in Vol. IV, on the existence of a single tibial spine!

189. The specimen here referred to is the species widely known as, and figured by Holland and Hampson as *alternata*. I have never taken another Alberta specimen that I know of, though it is common in Manitoba.

190. *Rhynchagrotis placida* Grt.—I have no good reason for supposing that I have confused more than one species under this name at Calgary, and I appear to have it correct. Some of the forms in this genus are more difficult to understand than some of the most variable Euxoas, but I feel sure that there are more names on the list than known species. Hampson places most of our species in the genus *Triphana* Hübner.

192. Sir George Hampson's remark before quoted under this head is interesting, as Prof. Smith subsequently described the form, from a single male I had sent him some years before, as *Aplectoides fales* (Journ. N. Y.

Ent. Soc., XIII, 192, Dec., 1905), that being the genus to which Hampson refers *pressa* and most of our *Platagrotis*. The description adds: "It is a broad-winged form more like *imperita* than *pressa*, and yet not unlike an obscurely marked *pressa*. . . . This may be really the male of *discolor*," and *discolor* is next described from two females from "Inverness and mouth of Skeena River, B. C." The types of the latter struck me as being like a white-grounded *pressa*. The suggestion that they may be sexes of one species seems quite reasonable. It may take more material from Northern B. C. to decide the matter, but if they are I would suggest further that the differences are not necessarily sexual. I can suggest nothing further about *discolor* for the present, but I believe *fales* to be merely a dull grayish *pressa*. I have specimens from Montreal, Ottawa, "E. Ontario," Cartwright, Man., and Kaslo, besides four from Calgary. Some eastern specimens are quite as gray as the local series, and they grade through in colour and everything else to the greenest. The type of *pressa* is a female from New York, but Hampson figures a male from "Canada." As a Calgary and California specimen stood in the British Museum I admit they looked distinct from the *pressa* series from New York and "Canada," but I quite failed to draw any line between the two series in Prof. Smith's collection. Nor can I agree that *fales* resembles *imperita* in that collection as much as it does typical *pressa*. The form should stand as *pressa* var. *fales*.

193. *Euretagrotis inattenta* Smith.—I have a good series taken locally and specimens from Cartwright and Miniota, Man., and Windermere, B. C. I have also a series of *perattenta* from Montreal and Ottawa. The eastern specimens are, as a whole, a bit brighter coloured and have the maculation more clearly written, and all the black markings a little heavier. I have one Calgary male, however, and have compared a similar one from Redver's, Sask., from Mr. Crocker, which resembles some eastern specimens almost exactly. I have local specimens grading almost exactly up to this. I hesitate to make the reference definitely at present, but have little doubt that the forms will be ultimately found to unite. I have seen a series in Mr. Cockle's collection at Kaslo which my notes say resembled the eastern rather than the prairie form, but have none from that locality in my collection. I have one from Vancouver Island which is certainly nearest the eastern form, but much brighter in colour, almost vinous red. My local dates read from June 24th to August 2nd, and it is occasionally not uncommon at both treacle and light. The type of

perattenta is a male from Evans Centre, N. Y., and is a very strongly marked specimen.

194. *Pachnobia littoralis* Pack.?—The Calgary species so referred is certainly *pectinata* Grote, of which the male type from Hall Valley, Colo., is figured by Sir George Hampson. I have a male from the type locality, from Dr. Barnes. I have not seen the type of *littoralis* from Caribou Island, Labrador, and therefore cannot directly dispute Prof. Smith's reference to that species. But if the description given in his Revision of *Agrotis* (Bull. 38, U. S. N. M., p. 205), is the original one of Packard, I do not feel sure of its identity. He describes what must be the t. a. line as "black, irregularly quadridentate." In some of my specimens the line might be called quadridentate, but in none that I have seen is it anything approaching to black. Then again, beyond the t. p. line is "a parallel line of dark streaks of uniform length," and beyond this again, the s. t. line. The line of dark streaks beyond the t. p. is non-existent in any of my specimens. Such variation is not impossible, but the above are two characters new to me.

196. *Agrotis aurulenta* Smith.—Another ♂ at light, July 23rd, 1905.

201. *Peridroma margaritosa* Haw.—It has long been a puzzle to me to know why *saucia* is the only varietal name standing in our lists for this very variable and somewhat ubiquitous North and South American, European, and Asiatic species. I have a good series from Calgary, Vancouver Island, and Stockton, Utah, and have seen numerous others. On this continent the species has an infinitely wider range of variation than the names *saucia* and *margaritosa* signify. Two names, *inermis* Harris, and *ortonii* Pack., stand in our lists as synonyms of "var. *saucia*," whether quite correctly or not I cannot say. Sir George Hampson lists nine other names as synonyms, though some of them I believe were described from North American material. If *saucia* was, that may account for the retention of the name on our lists to the exclusion of others. Hampson, after describing *margaritosa* as "brownish ochreous, irrorated with brown, lists 'Ab. 1' without name as: Fore wing dark brown, costal area, orbicular, subterminal area, and an apical patch gray, and 'Ab. 2,' *saucia*, . . . much more uniform gray-brown." Tutt, in "British Noctuae and Their Varieties," II, p. 5, 1892, lists eight varieties as British, including four of his own naming. He summarizes a description of Hübner's figure of *saucia*, which constitutes the type, as "blackish-gray,

with vinous-red costa." This does not quite tally with Hampson's *saucia*, though I have Calgary specimens fitting both. Tutt gives the original Latin description of Haworth's *margaritosa*, which was described as a distinct species. The colour description reads "*alis grises cinereis nebulosis*," which Tutt sounds right in translating "wings gray, clouded with ashy," but which is again at variance with Hampson's general description and sounds more like his *saucia*. I have a Calgary specimen which fits it beautifully. In addition to these, our species varies through many shades of gray, ochreous brown and vinous red; and specimens may be very uniform, or have the costal region either much the palest, or much the darkest part of the wing, or with various mixtures of shades. The way the names stand in our lists suggests either that *saucia* is the North American form of *margaritosa*, or that it is a well marked extreme form occurring with us as well as the type, whereas it merely represents one phase, and a by no means striking one, of a long range of variation. It is inexplicable why *saucia* should be retained in our lists as a variety, whilst such strikingly unlike forms of *ochrogaster* as *gularis*, *turris*, and *insignata* (as instances amongst many), be passed as mere synonyms.

202. *Noctua baja* Fabr.—This species is listed as *smithii* Snellen, in Prof. Smith's Check List, 1903, on the authority of Snellen, whom I also followed. It was claimed by its author that our North American form had spined fore tibiae, whereas that occurring in Europe, although superficially almost exactly like ours, had not. (Smith, in Journ. N. Y. Ent. Soc. VI, 99, 1898). Dr. Dyar erred in omitting any reference to *baja* whatever in listing our species as *smithii* in his Catalogue. But in the Kaslo List he restores the old name, remarking: "An examination of European specimens shows them to have several distinct spines toward the tip of the member, well hidden in the vestiture." I have lately carefully examined fourteen British specimens of *baja*, and find spines on the inside tibiae of seven. In a few of these I can find a single spine only, just at the tip; in others there are three or four, rather obvious. As a rule the vestiture on tibiae of my British specimens seems rather thicker than in most of the North American series, but not constantly so. Whether spines are merely concealed or absent from the rest I cannot say. The fore tibiae of most of my native *baja* are not in a position to permit of careful examination, but spines appear to be rather obvious in most of those that are, in varying numbers up to five. In one, at least, in which the tibiae are well

spread, I can detect none. Even if their existence is not a variable character, their prominence most certainly is, on both continents, and *smithii* must be dropped. Sir George Hampson makes it a synonym.

204. *N. patefacta* Smith.—Sir George Hampson treats *juncta* as distinct, figuring the male type from Nova Scotia. It has head and thorax paler than the wings, and collar still paler tipped. I have seen no other specimens like it. The wings are paler than the average run of *patefacta*, but they are pretty obviously faded, as Grote says it resembles *treatii* in its "dead black primaries." The type was a unique, taken by and received from Mr. Roland Thaxter, and is badly rubbed. I have one *patefacta* almost as dark as most *treatii*, and they vary to as pale as Hampson's figured *juncta*. In one of my specimens the spots do not join on one side, and scarcely so on the other. But in all the thorax is unicolorous with primaries, though the tip of the collar is sometimes appreciably paler. Their distinctness from Grote's species is perhaps a doubtful point, but, as Sir George Hampson thinks, they may as well be kept apart, pending the discovery of more specimens from Nova Scotia, or thereabouts. There are two specimens of *patefacta* from Yellowstone Park in the American Museum of Natural History.

205. *N. cynica* Smith, var. *perumbrosa* Dyar.—I took several specimens of this form on the wing after dark and at treacle between July 31st and August 15th, 1909, and conclude that it is correctly named. I have a Kaslo series, some of them co-types, and have seen about thirty co-types at Washington, besides the type of *cynica*, which seemed a paler form of the same species. Prof. Smith states under his description of *cynica* that his specimen came from Albany, N. Y. The only type I have recorded having seen is a male at Washington which is labelled "Bailey, /83." It was described as distinct from *rubifera* in being broader winged, lacking a median shade (which it was suggested might not be constant), and having totally different male genitalia. These are shown of both species, and certainly indicate some strong differences.

My Calgary specimens are darker than most seen from Kaslo, and have darker secondaries. Some of the Kaslo specimens are not a bit darker than any of a series of six females that I have from Ottawa as *rubifera*, and look the same. One of the latter is almost exactly like Hampson's figure of *rubifera* female type, noted in the key as a male from New York, but merely labelled "U. S. A." This type he calls

"Ab. 1," it differing from others in having black before and between stigmata, a common phase of variation in this group and allies. A central shade is indicated in the tables, but not mentioned in description or shown in figure. It is a still more common phase of variation in allied species. It seems that there is really nothing tangible to separate *cynica* from *rubifera* unless by the male genitalia. I should like to see a good series of figures from males of both from the same locality.

(To be continued.)

COLLECTING NOTES FROM CARTWRIGHT, MANITOBA,

We have had and suffered somewhat from a Yankee invasion in this neighbourhood. A swarm of *Cantharis nuttalli* has come north out of Dakota, and done some damage in gardens about Cartwright. A neighbour of mine, an Englishman, has had all his broad beans eaten by them. So the poor fellow will have no "beans and bacon" this year. He is an advocate of reciprocity, so I tell him he has no cause to grumble. It is only what he may expect, and things much worse, if that very one-sided arrangement is carried into effect.

This *Cantharis*, I may add, used to be rather abundant on the unbroken prairie in my early days. It fed upon one of the vetches. I forget its botanical name, but it is locally called the "buffalo bean." It was a lovely sight to see two or three of them on the vetch flowers in the bright sunshine, shining like emeralds shot with purple.

In my early days *Pieris protodice* was the common "white" of the prairies. I am speaking of the "eighties." As *rapae* reached here *protodice* gradually disappeared, and for years I have not seen a specimen. On July 12th, when walking through a scrubby corner of my pasture, I netted a "white" that came past me, killed it, thinking it was *rapae*, and was turning it out of my net when, to my surprise, I found it was a *protodice* ♀. Since then, about the same place, I have seen a second.

A few nights on and after June 20th were favourable for collecting at light, and I made some interesting captures on my windows and in my trap, which will appear in Mr. Arthur Gibson's record. One curious thing I noticed was that every night at 12 o'clock, as punctually as possible, *Belostoma americanum* began to come to the light, and kept me busy catching and killing them, as these great water-bugs, banging about the window, drive away many desirable moths.

The Hermitage, near Cartwright, Manitoba.

July 18th, 1911.

E. FIRMSTONE HEATH.

THE George Washington University has conferred the honorary degree of Doctor of Medicine on Dr. L. O. Howard, Chief of the Bureau of Entomology and Permanent Secretary of the American Association for the Advancement of Science, for "distinguished services to science in relation to preventive medicine."—[*Science*.]

BOOK NOTICE.

ANNUAL REPORT OF THE NEW JERSEY STATE MUSEUM, including a Report of the Insects of New Jersey, for 1909. Prepared under the direction of Prof. John B. Smith, State Entomologist.

The first edition of the "Insects of New Jersey" was published in 1890 and a second in 1900. As the latter has long been exhausted, and as there has been so much demand for it, the present one was issued in 1910. It contains the Curator's Report, followed by :

Part I.—Treating of insects, their classification and distribution. This is divided into four chapters, which give a good general account of the classification, development and faunal characteristics of insects, and of the benefits and injuries caused by them.

Part II.—Comprising a systematic list, embracing twenty-two orders of insects. Each order is characterized and a general account given of the habits of its members, whether beneficial, injurious or of no material economic importance. The families in general are similarly treated. Illustrations numbering 340, of which many include from two to eight figures, are interspersed throughout.

The present edition contains records of 331 families, 3,486 genera and 10,385 species, the list of species being 1,845 in excess of the previous list, and 4,287 of the early one. The localities of most of the species are given, together with the dates of appearance, habits in the various stages, and food-plants ; thus making a volume that is of inestimable value to all classes of entomologists, nature students and collectors, and the only work covering such a broad field of entomology that has been published by any State of the Union or by any public or private institution.

The Report is also furnished with indices to localities and to families and genera, and a coloured map shewing the faunal regions of the State.

J. D. E.

Mailed September 6th, 1911.

